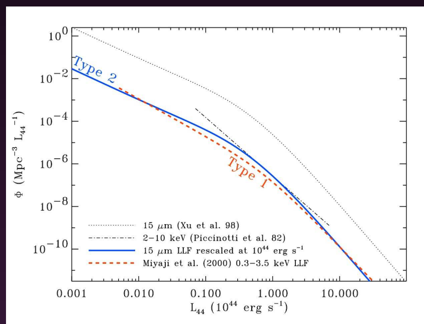
X-ray Background Synthesis: the Infrared Connection

P. Gandhi (ESO Chile), A.C. Fabian (IoA Cambridge)

The following model assumes that type 1 unobscured AGN are distributed according to the X-ray luminosity function (XLF) found by ROSAT (Miyaji et al. 2000, A&A, 353, 25). The obscured type 2 AGN (N_H>10^{22} cm^{-2}) follow an XLF that is similar to the infrared LF observed for luminous infrared galaxies (Xu et al. 1998, ApJ, 508, 576), except for a scaling factor. The model achieves reasonable success in fitting the X-ray background spectrum over 5-100 keV, the 2-10 keV log*N*-log*S* and the low-z peak in the redshift distribution n(z) observed in deep fields. The model is completely consistent with n(z) at brighter fluxes (c.f. Gilli 2003, astro-ph/0303115; Ueda et al. 2003, ApJ, astro-ph/0308140), while the type 2:type 1 ratio is larger at low z.

Motivation

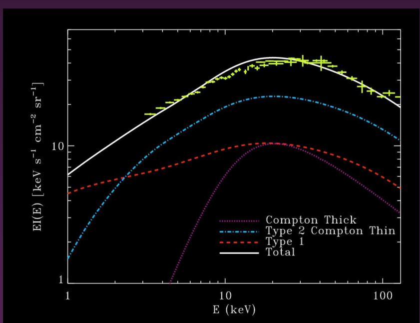
- z<1 peak in distribution of AGN selected in X-rays.
- Low z peak seen in distribution of luminous IR galaxies.
- Large overlap of X-ray and IR detections (Fadda et al. 2002, A&A, 383, 838).

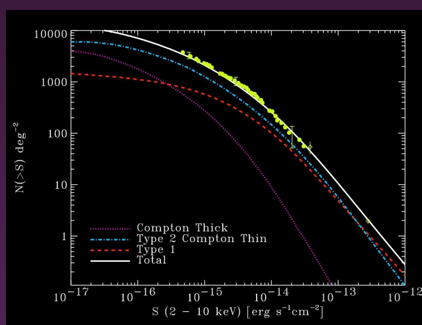


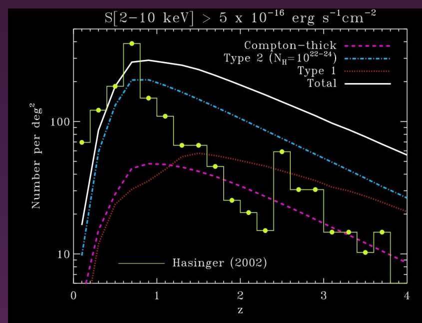
Ingredients of model

- LFs – figure on left.
- X-ray spectra for different obscurations (Wilman & Fabian, MNRAS, 1999, 309, 862).
- Luminosity and density evolution with z (power-law).
- Power-law N_H distribution.

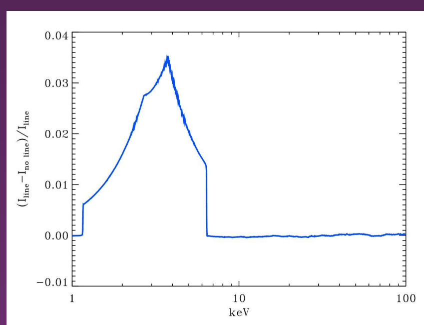
Modelled XRB spectrum, 2-10 keV log*N*-log*S* & peak of n(z) agree with observations:
For n(z), normalization of observations (which are >40% incomplete) is at z=0.5





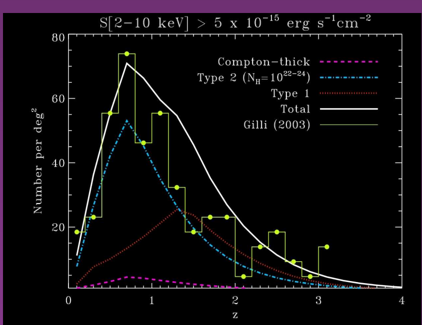


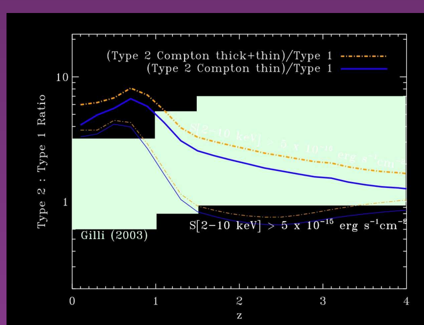
Using, instead, spectra with Fe K emission lines of reasonable strengths (Leighy & Creighton, 1993, MNRAS, 263, 314), a weak excess of ~ a few percent is predicted for the spectrum of the XRB, with the peak being at ~3.8 keV redshifted from a rest-frame 6.4 keV at z=0.7.



At a brighter flux $S_{2\text{-}10}$>$5\text{x}10^{-15}$ erg/s/cm^2, Gilli (2003) has compiled a sample that is 80% complete. Our model is able to fit the peak and shape of the n(z) to z=3, with room for unidentified sources at z 1 (figure below far left).

The bulk of the low z peak is produced by obscured AGN, implying evolution of the type 2: type 1 ratio. This ratio lies between 1 and 7 with a peak at z=0.7, not counting Compton-thick AGN. At brighter fluxes, the ratio varies between 0.7-4 (figure on left).





More details in Gandhi & Fabian, 2003, MNRAS, 339, 1095